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Seasonal elevation changes in the Greenland Ice Sheet from CryoSat-2 altimetry

Thomas Slater¹, Andrew Shepherd¹, Malcolm McMillan², Amber Leeson², Lin Gilbert³, and Kate Briggs¹

¹Centre for Polar Observation and Modelling, University of Leeds, United Kingdom

²Lancaster Environment Centre/Data Science Institute, Lancaster University, United Kingdom

³Centre for Polar Observation and Modelling, University College London, London

Seasonal changes in the elevation of the Greenland Ice Sheet below the equilibrium line altitude are driven by ice dynamics and fluctuations in surface melting and snowfall accumulation. Here, we use CryoSat-2 altimetry to estimate summer and winter elevation changes in the ablation area of the Greenland Ice Sheet between 2011 and 2019. During this period, we find average summer and winter elevation trends of -2.52 ± 0.68 m/yr and 0.90 ± 0.39 m/yr, respectively. While the rate at which the ablation zone thickens in winter due to snowfall has remained relatively stable, variability in ice thinning in the summer due to surface melting has followed recent changes in atmospheric circulation. In combination with a regional climate model, we examine patterns of change associated with ice sheet dynamics on both multi-annual and seasonal timescales. At the ice sheet scale, we find our altimeter record of height change within the ablation zone strongly agrees with regional climate model reconstructions of elevation change due to surface processes alone. Between 2011 and 2019, we estimate that the ablation zone of the Greenland Ice Sheet has thinned by 3.86 ± 0.30 m from CryoSat-2 altimetry.